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U. S. Nuclear Regulatory Commission
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Gentlemen:

LER 311/01-008-00
SALEM GENERATING STATION - UNIT 2
FACILITY OPERATING LICENSE NO. DPR-70
DOCKET NO. 50-311

Licensee Event Report, "Reactor Trip Due to Pressurizer Spray Valve 2PS3 Failure", is
being submitted pursuant to the requirements of the Code of Federal Regulations
10CFR50.73(a)(2)(iv)(A).

The attached LER contains no commitments.

Sincerely,

D. F. Garchow
Vice President - Operations

Attachment

/HGB

C Distribution
 LER File 3.7

IE22

Estimated burden per response to comply with this mandatory information collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of
digits/characters for each block)

| | | |
|---|--|---------------------------------|
| 1. FACILITY NAME SALEM GENERATING STATION UNIT 2 | 2. DOCKET NUMBER 05000311 | 3. PAGE 1 OF 4 |
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4. TITLE**Reactor Trip Due to Pressurizer Spray Valve 2PS3 Failure**

| | | | | | | | | | | |
|------------------------------|-----|------|--|----------------------|--------------------|-----------------------|----------------------|------|-------------------------------------|---------------|
| 5. EVENT DATE | | | 6. LER NUMBER | | | 7. REPORT DATE | | | 8. OTHER FACILITIES INVOLVED | |
| MO | DAY | YEAR | YEAR | SEQUENTIAL NUMBER | REV NO | MO | DAY | YEAR | FACILITY NAME | DOCKET NUMBER |
| 12 | 31 | 01 | 01 | 008 | 00 | 02 | 28 | 02 | | 05000 |
| 9. OPERATING MODE | | | 11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply) | | | | | | | |
| 1 | | | 20.2201(b) | | 20.2203(a)(3)(ii) | | 50.73(a)(2)(ii)(B) | | 50.73(a)(2)(ix)(A) | |
| 10. POWER LEVEL | | | 20.2201(d) | | 20.2203(a)(4) | | 50.73(a)(2)(iii) | | 50.73(a)(2)(x) | |
| 100 | | | 20.2203(a)(1) | | 50.36(c)(1)(i)(A) | | X 50.73(a)(2)(iv)(A) | | 73.71(a)(4) | |
| | | | 20.2203(a)(2)(i) | | 50.36(c)(1)(ii)(A) | | 50.73(a)(2)(v)(A) | | 73.71(a)(5) | |
| | | | 20.2203(a)(2)(ii) | | 50.36(c)(2) | | 50.73(a)(2)(v)(B) | | OTHER | |
| | | | 20.2203(a)(2)(iii) | | 50.46(a)(3)(ii) | | 50.73(a)(2)(v)(C) | | Specify in Abstract below or in | |
| | | | 20.2203(a)(2)(iv) | | 50.73(a)(2)(i)(A) | | 50.73(a)(2)(v)(D) | | NRC Form 366A | |
| | | | 20.2203(a)(2)(v) | | 50.73(a)(2)(i)(B) | | 50.73(a)(2)(vii) | | | |
| | | | 20.2203(a)(2)(vi) | | 50.73(a)(2)(i)(C) | | 50.73(a)(2)(viii)(A) | | | |
| | | | 20.2203(a)(3)(i) | | 50.73(a)(2)(ii)(A) | | 50.73(a)(2)(viii)(B) | | | |

12. LICENSEE CONTACT FOR THIS LER

| | |
|--|---|
| NAME Howard G. Berrick, Licensing Engineer | TELEPHONE NUMBER (Include Area Code) 856-339-1862 |
|--|---|

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

| CAUSE | SYSTEM | COMPONENT | MANU- FACTURER | REPORTABLE TO EPIX | CAUSE | SYSTEM | COMPONENT | MANU- FACTURER | REPORTABLE TO EPIX |
|-------|--------|-----------|-------------------|-----------------------|-------|--------|-----------|-------------------|-----------------------|
| B | AB | PCV | C635 | Y | | | | | |

14. SUPPLEMENTAL REPORT EXPECTED

| | | | | | | |
|---|---|----|---|-------|-----|------|
| YES (If yes, complete EXPECTED SUBMISSION DATE) | X | NO | 15. EXPECTED SUBMISSION DATE | MONTH | DAY | YEAR |
| | | | | | | |

16. ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On December 31, 2001, at approximately 0009 hours, with Salem Unit 2 operating at 100 percent power, an automatic reactor trip followed by a safety injection (SI) actuation occurred. Earlier, the Reactor Coolant System Pressurizer "low pressure/heaters on" alarm had annunciated and the operators observed Pressurizer pressure decreasing. The Pressurizer master controller called for no sprays and more heaters. Both spray valve controllers demanded closing. Spray valve 2PS1 indicated full closed (green light), but 2PS3 indicated mid-position (no red or green lights). The control room operator attempted to manually close the 2PS3 spray valve from the control console, but the valve failed to respond. The control room supervisor (CRS) directed the reactor operator to take the master controller to manual and attempt to close the valve, but the valve still did not respond. The CRS entered the abnormal operating procedure (AOP) for Pressurizer pressure malfunction and the operations superintendent recommended initiation of a manual reactor trip and stopping No. 23 reactor coolant pump (RCP). As the CRS was acknowledging the recommendation, the unit tripped on over-temperature delta-T (OTDT) followed shortly thereafter by a safety injection on low Pressurizer pressure signal.

The cause of this event was the Pressurizer spray valve 2PS3 failing to an open position. The valve failed to this open position because of a broken position feedback linkage. The position feedback linkage was replaced on both Unit 2 Pressurizer spray valves and Unit 2 returned to service.

This event is reportable in accordance with 10CFR50.73(a)(2)(iv)(A).

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

PLANT AND SYSTEM IDENTIFICATION

Westinghouse – Pressurized Water Reactor, Reactor Coolant System (RCS) {AB/-}

* Energy Industry Identification System {EIIS} codes and component function identifier codes appear as (SS/CCC)

CONDITIONS PRIOR TO OCCURRENCE

Salem Unit 2 was in Mode 1 at 100% power prior to this event.

No Structures, systems or components were inoperable at the time of the occurrence that contributed to this event.

DESCRIPTION OF OCCURRENCE

On December 31, 2001, at approximately 0007 hours, with Salem Unit 2 operating at 100 percent power, operators received an Overhead Annunciator (OHA) alarm OHA E-28, Reactor Coolant System {AB/-} Pressurizer “low pressure/heaters on” and observed Pressurizer pressure decreasing.

The Pressurizer master controller called for no sprays and more heaters. Both spray valve controllers demanded closing. Spray valve 2PS1 indicated full closed (green light), but 2PS3 indicated mid-position (no red or green lights). The control room operator attempted to manually close the 2PS3 spray valve from the control console, but the valve failed to respond. The control room supervisor (CRS) directed the reactor operator to take the master controller to manual and attempt to close the valve, but the valve still did not respond. The CRS entered the abnormal operating procedure (AOP) for Pressurizer pressure malfunction and the operations superintendent recommended initiation of a manual reactor trip and stopping No. 23 reactor coolant pump (RCP). At approx 0009 hours, as the CRS was acknowledging the recommendation, the unit tripped on over-temperature delta-T (OTDT) followed shortly thereafter by a safety injection (SI) on low Pressurizer pressure signal. The OTDT trip initiated at 1972 psig approximately 2 minutes and 13 seconds after the initial “low pressure/heaters on” alarm and the Pressurizer low pressure SI was initiated at 1765 psig 16 seconds later. All emergency diesels started but did not load, as designed, and all Emergency Core Cooling System (ECCS) pumps started as required. Auxiliary Feedwater pumps started on low Steam Generator level and control rods fully inserted. As part of the SI the Control Air System containment isolation valves 21 and 22CA330 closed automatically. This resulted in a loss of air to 2PS3 and it closed because it is a fail close valve upon loss of air.

The CRS then entered the emergency operating procedure (EOP) for reactor trip and safety injection. After the immediate actions were completed, the Shift Technical Advisor (STA), who was reviewing the Pressurizer pressure malfunction AOP, advised the CRS that 23 Reactor Coolant Pump (RCP) should be stopped. Control room personnel stopped 23 RCP. The remaining actions in reactor trip EOP were completed and the control room staff transitioned to the safety injection termination EOP. This procedure directs opening of the 21 and 22CA330 (control air containment isolation valves) to restore control air to the containment. The staff noted that the 2PS3 would reopen when air was restored and were monitoring Pressurizer pressure.

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DESCRIPTION OF OCCURRENCE (cont'd)

When 21 and 22CA330 were opened, Pressurizer pressure started decreasing. The CRS directed the valves be re-closed to maintain reactor coolant system (RCS) pressure. At this time the Pressurizer was filling quickly and the SI had not been stopped. The next steps were to secure a charging pump and restore normal charging and letdown. Another attempt was made to open valves 21 and 22CA330. After the first valve was opened, Pressurizer pressure started decreasing again and the operator re-closed the valve again. Realizing that spray flow still existed, the CRS requested the STA to check the RCP normal operating procedure to verify the proper configuration for two-pump operation and 22 RCP was stopped. Valves 21 and 22CA330 were opened again and pressure started decreasing. The CRS then directed the valves to be re-closed once more and 21 RCP be stopped. Valves 21 and 22CA330 were then re-opened and pressure remained stable. Normal charging and letdown were restored along with excess letdown. Pressurizer level, which had gone off-scale high, was restored to normal. Although Pressurizer level indication was off-scale, the Pressurizer was not water solid [as indicated by Pressurizer pressure indication and response]. The SI termination EOP was completed, and the staff transitioned to integrated operating procedure for maintaining the reactor in hot standby. The 2PS3 was subsequently isolated manually.

The remaining plant equipment operated satisfactorily during the transient with the exception of the 21 Steam Generator Feedwater Control valve which did not fully close, and three Main Steam Isolation Valves (MSIVs) that drifted from their full open position (and subsequently re-opened to full open).

CAUSE OF OCCURRENCE

The direct cause of the reactor trip and safety injection was failure of the 2PS3 Pressurizer Spray control valve to close due to cyclic fatigue failure of the standoff arm portion of the valve position feedback assembly to the positioner. The fatigue failure occurred on an incorrect standoff arm that was installed. This part is one of 40 possible linkages for the Moore model 72 positioners used on Copes-Vulcan D-100-160 control valves, and was not specified at the time of positioner change in 1989. Material cyclic fatigue failure of the standoff arm of the feedback linkage assembly has been confirmed by metallurgical analysis. The incorrect standoff arm installation was isolated to the Unit 2 PS1 and PS3 valves only. Contributing factors included the Operators not being able to isolate or close 2PS3 from the control room, and the Abnormal Operating Procedures did not provide adequate means of controlling and stabilizing decreasing Pressurizer pressure with a failed open spray valve.

PRIOR SIMILAR OCCURRENCES

A review of LERs over the past two years for Salem Unit 1, Salem Unit 2 and Hope Creek identified no similar occurrences with Pressurizer Spray valve failures, nor have similar occurrences of valve positioner failures occurred over the past three years.

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SAFETY CONSEQUENCES AND IMPLICATIONS

The failed-open spray valve caused Pressurizer depressurization, resulting in an automatic actuation of the reactor trip on over-temperature delta-T (OTDT), prior to operators' action to manually trip the unit, and subsequent safety injection on low Pressurizer pressure signal. All safety systems performed as designed in response to the trip. The remaining plant equipment operated satisfactorily during the transient, with the following exceptions: the 21 Steam Generator Feedwater control valve, S2CN -21BF19, stuck in a partially open position (locally, 21BF19 indicated approximately 10% open) and three (3) Main Steam Isolation Valves (MSIVs) drifted from their full open position. They were subsequently reopened.

No credit is taken to mitigate the consequences of any transient in the safety analysis for operation of the Pressurizer spray valves. Termination of overpressure transients is achieved by the Pressurizer Safety Valves and/or by reactor trip. Therefore, there were no actual safety consequences associated with this event, and this event did not present a risk to the health and safety of the public.

Although there were no actual safety consequences, this event resulted in a decrease in reactor coolant system pressure that initiated a reactor trip and an automatic safety injection actuation. In addition the failed valve was specified as a fail close valve, but in this event failed to an open position. However, control room operators recognized the equipment malfunction and mitigated the consequences by stopping reactor coolant pumps to stabilize plant conditions.

CORRECTIVE ACTIONS:

1. Replaced the position feedback linkage assembly for positioners of valves 2PS1 and 2PS3.
2. Visually inspected all valve positioners with similar position feedback linkages for both Salem units. No discrepancies were identified.
3. Revised and issued procedure S2.OP-AB.PZR-0001 (Q), "Pressurizer Pressure Malfunction" to address responses to a failure of a Pressurizer spray valve to a failed open position.
4. A Root Cause Investigation of this event is in progress. Additional corrective actions may be taken, as necessary, as a result of the completion of the root cause investigation into this event. These actions will be included in the PSEG Nuclear corrective action program.

COMMITMENTS

The corrective actions cited in this LER are voluntary enhancements and do not constitute commitments.